

Fam. ORBITULITIDÆ.

1. Orbitulites coscinodiscus, n. s.

Sutton. |

Polypid. discoidal, smooth, flat; cells concentric, linear, and radiating in straight lines.

The cells differ in form and arrangement from those of *Orb. complanata*.

Ord. CARNOSA.

Fam. ALCYONIDIADÆ.

Cor. Crag.

Red Crag.

Recent.

1. Alcyonidium circumvestiens, n. s.

Sutton. |

Sutton. |

Polypid. enveloping univalve shells, surface papilliform and rugose.

This covering attains a thickness of more than half an inch, and can be partially removed in layers; in some instances the univalve is entirely absorbed. Not restricted to one species of shell.

Class AMORPHOZOA.

1. Grantia compressa, Johnston (*Brit. Sponges*, p. 174. pl. 20. f. 1).

| Walton Naze.

| Britain.

Three very minute specimens, found by Dr. Johnston adhering to the interior of a shell.

Class LITHOPHYTA.

1. Nullipora.

Sutton. |

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IV.—On the existence of Branchiæ in the perfect state of a Neuropterous Insect, *Pteronarcys regalis*, Newm., and other species of the same genus. By GEORGE NEWPORT, Pres. Ent. Soc. &c.\*

HAVING been favoured by Mr. Barnstone with a specimen of that magnificent Neuropterous insect, *Pteronarcys regalis*, captured by himself in the high latitude of 54° on the Albany river, North America†, and preserved in spirit, I have been agreeably surprised at finding in the perfect state of this species a series of thoracic branchiæ, a condition of the external respiratory organs that is usually met with only in the preparatory larva and pupa states of insects. The persistence of external branchiæ in a winged insect, fitted in every other way for flight in the open atmosphere, like other species of the order to which it belongs, is an anomaly that requires a close attention to its habits to explain. This is the only genus, so far as I am aware, in which the branchial form of the respiratory organs, so common in the larva and pupa of the

\* Read at the meeting of the Entomological Society, December 4, 1843.

† It was brought by Mr. Barnstone with a large collection of Canadian insects which he had recently captured, and has since presented to the British Museum.

Neuroptera, is retained in the perfect state. On first observing these organs, in the specimen received from Mr. Barnstone, I was disposed to regard them only as an accidental occurrence; but I have subsequently detected the remains of them in every dried specimen I have had an opportunity of examining; and also in the pupa of the same species, in which, however, they are somewhat more developed. They are of the tufted or filamentous form of branchiæ. They consist of eight pairs of branchial sacs, from the exterior of which proceed numerous elongated, setose filaments, which together form a thick tuft on each sac. These branchiæ are situated, as described by Pictet in the larva state of *Nemoura cinerea*, Pictet, over the proper spiracular orifices or entrances to the great longitudinal tracheæ of the body, at the inferior lateral parts of the thorax and basilar segments of the abdomen. The first pair of sacs is in the tegument of the neck, between the head and prosternum; the second and third pairs, each of which is composed of two tufts, between the prosternum and mesosternum, behind the coxæ of the first pair of legs; the fourth and fifth between the mesosternum and metasternum, behind the coxæ of the second pair of legs; and the sixth pair behind those of the third pair of legs, at the junction of the thorax with the abdomen. The seventh and eighth pairs, formed each of single tufts, are attached more laterally, the seventh to the first, and the eighth to the second basilar segments of the abdomen. These latter branchiæ correspond in situation in the segments to that of some apparently closed or obsolete spiracles at the sides of the succeeding segments. The situation of the branchiæ themselves is thus as anomalous as their existence in the perfect insect. In most instances branchiæ are arranged along the sides of the abdominal segments of the larva, and are often employed to assist in locomotion; but they cannot be of use for this purpose in the larvæ and pupæ of these *Perlida* which move by means of large and powerful limbs. In *Pteronarcys* the two posterior pairs of legs of the pupa have the tibiæ densely ciliated, for swimming, like those of the *Dyticidæ*, so that the delicate filamentose branchiæ can afford little, if any, assistance in this function. The structure of the filaments themselves differs also from that of the filamentose branchiæ of the *Sialidæ*, in which these organs are said to be quadri- or quinque-articulated, and are employed as organs of locomotion. In *Pteronarcys* they are simple unarticulated filaments. Each filament is soft, delicate and gradually tapered from its base to its extremity, and ends in a slightly obtuse point. Internally each filament is traversed longitudinally by a tracheal vessel, which becomes, like the filament itself, more and more slender, and at last divides into two branches, which may be traced to the extremity of the filament; but I have not been able

to discover any orifice in the extremity of the filament itself, nor any direct communication whatever between the external surface and the ramifications of these tracheæ, and I doubt much whether any such direct communication exists.

M. Pictet has found that branchiæ are attached to the thorax of the *larva* in all the species of *Perla* excepting *P. virescens* and *P. nigra*, which circumstance seems to indicate some difference in the habits of these species. Now a like difference exists between the pupa of *Pteronarcys regalis* and that of *Perla abnormis*, Newm., which latter insect has not these branchiæ; and Mr. Barnstone, who has most assiduously observed the habits of these species, informs me that he found the first living constantly in the water at the bottom of streams, but the latter was always hidden in clefts of water-logged timber, the trunks of trees and other places on the banks, and that he has usually found the cast-off exuviæ of the pupa "under stones along the banks of rivers." This difference in the habits of the pupæ leads to further inquiry in regard to those of the perfect insects. *P. regalis* he states is a nocturnal species, being mostly found hidden by day under stones or in damp places, and coming abroad on the wing only at night-fall. Has this habit any reference to the persistence of the branchiæ, and the mode in which the aëration of the fluids is effected? or are these persistent branchiæ merely accidentally retained organs, the functions of aëration being performed by other means? The existence of three pairs of orifices on the sternal surface of the thorax seems at first to favour this latter conclusion; but it yet remains to be shown that these orifices have any communication with the tracheæ, since they are placed in the middle of the sternal portion of each of the segments, between the coxæ, situations in which spiracles do not usually exist. This question, therefore, I leave for the present for closer anatomical investigation.

In regard to the function of aëration being performed by these branchiæ in the perfect insect, I may remark, that it is of little consequence to the preservation of animal life whether aëration of the fluids of the body be effected *directly*, by means of air received *into* the body in lungs, or in spiracles and tracheæ, or *indirectly*, by means of water or vapour, that holds air intermixed with it, through the agency of external branchial organs, in which case the air is brought into contact with the fluids through the surface of these organs in water equally well as in the open atmosphere, when air is taken *into* the body through the spiracles. The function of branchiæ, or aquatic organs, is equally well performed in the open air as in water, so long as the air is charged with a sufficiency of fluid to preserve these organs in a healthy state.

Some circumstances connected with the respiration of larvæ

distinctly show this to be the case, and also have reference to the apparently anomalous persistence of branchiæ as respiratory organs in *Pteronarcys*. Mr. Westwood in his 'Modern Classification of Insects\*' has quoted, as a remarkable circumstance connected with the respiration of the *Sialidæ*, an observation made by M. Pictet, "that one of these larvæ lived fifteen days in the earth before it changed to the pupa, being," he remarks, "the only instance of an insect furnished with external respiratory organs respiring the ordinary atmospheric air." I cannot perceive, however, what our worthy friend, or M. Pictet, from whom he quotes the fact, has discovered so exceedingly wonderful in this circumstance. There is nothing more remarkable in this fact, than in that of the common caterpillar of the Sphinx remaining unchanged in its cell in moist earth for many days before it enters the pupa state. The truth is, that as the period of change approaches, the respiration of the larva is reduced to its minimum, and is almost entirely suspended; consequently the medium in which the insect is placed, whether it be water, or air saturated with that fluid, as it necessarily must be in a cell of moist earth, is as well fitted for branchial respiration as water itself. That the functions of branchiæ are fulfilled under these circumstances, I need but, in proof, direct attention to the known fact that Crustacea will continue to respire in the open air for an indefinite length of time, so long as their branchiæ are kept moist by fluid retained beneath the folds of the thorax. In closing these remarks I again refer to the question, have the habits of *Pteronarcys* any reference to the branchial structures in the perfect insect? My own opinion inclines strongly to the affirmative. The *Pteronarcys* shun the open day, during which they remain secluded beneath stones or in damp places, where the air is charged with moisture. They come abroad at night, and are constantly in the neighbourhood of streams and rivers, in which localities also the air is saturated with moisture. Under either of these circumstances the branchiæ may be sufficient for all the purposes of aëration.

I may also further observe, that branchiæ appear to be a well-marked generic character of these insects, although hitherto overlooked. In the dried specimens they become shrivelled, and are almost lost; but I have had the satisfaction of detecting the remains of them in the original specimens described by Mr. Newman, and now in the collection of the Entomological Club. They are in so shrivelled a condition as to have been easily overlooked; and would not, probably, have at all been recognised were they not first seen in this recent and well-preserved specimen in spirit †.

\* Vol. ii. p. 50, note.

† The specimen preserved by Mr. Barnstone in spirit was exhibited at the meeting.

The species in which these branchiæ exist in the perfect state are *Pteronarcys regalis*, *P. biloba*, *P. proteus*, and also in an undescribed species brought by Mr. Doubleday from New York, and now in the same collection.

V.—*A List of Lichens gathered in different parts of Wales, principally in the neighbourhood of Barmouth, with a few casual observations upon some of the species.* By the Rev. T. SALWEY.

THE species common everywhere are omitted, unless marked by some peculiarity of growth. All the habitats, except where it is otherwise specified, are in the neighbourhood of Barmouth.

*Bæomyces roseus*. Hill above the half-way-house between Barmouth and Dolgelley.

———— *rufus*. Walls and rocks. I have gathered this so finely developed upon decayed turf as to look like a different plant.

———— *placophyllus*. Rocks above Corwen: this habitat was first pointed out to me by Mr. Borrer; top of Snowdon, and in fruit at the top of Cader Idris, Mr. Ralfs.

———— *anomalus*. On rocks at Crafnant near Llanbedr, and above Gwastad-annos; on a rock below the Tannery, Mr. Ralfs.

*Calicium*. I have only met hitherto with a few of the common species of this genus in Wales.

*Opegrapha saxatilis*. Not uncommon on mortar and hard sandstone: on an old building at Llanaber by the side of the turnpike-road.

———— *dendritica*. On old trees at Cors-y-gedol. Two or three curious varieties of this occur upon trees at Holyland near Pembroke.

*Verrucaria leucocephala*. On old oaks at Wyunstay.

———— *lavata*. In the stream at Cors-y-gedol and below Cwm Bychan.

———— *maura*. Upon stones on the shore at Barmouth, principally on the south side of the ferry, and on rocks upon the Mowddach.

———— *crysiboda*. Arddog.

———— *viridula*. On a rock below the Tannery, Mr. Ralfs.

———— *muralis*. On old mortar. Pont Ysgethin, Pont Fadog, &c.

*Endocarpon miniatum*, with its varieties: common.

———— *leptophyllum*. Llyn Bodlyn, Llyn Howel, &c.

———— *pulchellum*. Common: Ty Gwyn, &c.

———— *late-virens*. Common on the tops of the hills.

———— *smaragdulum*. Common on walls; on the wall near the third milestone on Dolgelley-road, and above Aber-Artro.

———— *sinopicum*. Abundant in several places on the rocks by the side of the turnpike-road between Barmouth and Dolgelley; Bod Owen, Borthwnog, &c.

*Pertusaria ceuthocarpa*. Rocks and walls: above the Harlech turnpike at Barmouth.